IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Shunpei Yamazaki et al. Art Unit : 2812
Serial No. : 10/081,971 Examiner : Savitri Mulpuri
Filed : February 20, 2002
Title : METHOD AND APPARATUS FOR FILM DEPOSITION

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Commissioner for Patents
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BRIEF ON APPEAL

(1) Real Party in Interest

Semiconductor Energy Laboratory Co., Ltd., the assignee of this application, is the real party in interest.

(2) Related Appeals and Interferences

There are no related appeals or interferences.

(3) Status of Claims

Claims 1-11, 19, 20 and 24-54 are pending, with claims 1, 19, 20, 33, 44 and 51 being independent. Claims 12-18 and 21-23 have been canceled, and claims 20 and 51-54 have been allowed.

(4) Status of Amendments

Dependent claim 8 was amended to correct its dependency after the final rejection dated March 28, 2005. It is unclear whether this amendment has been entered, but appellant assumes that it has.

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(5) Summary of Claimed Subject Matter

The rejected claims are directed to methods of depositing a layer that include forming a first function region having a first organic compound on an electrode, forming a mixed region having the first organic compound and a second organic compound on the first function region, and forming a second function region having the second organic compound on the mixed region.

The claims further recite that one or more of the function regions and the mixed region are formed during irradiation with light in a deposition chamber. As set forth in the application at, for example, page 10, lines 8-10, the recited arrangement of a first function region, a mixed region, and a second function region may provide the considerable advantage of moderating the energy barrier between the function regions so as to improve carrier injectability and avoid reductions in drive voltage and luminance.

The layer may be used as the luminescent film in an organic luminescent element also having an anode and a cathode on either side of the film. See the application at page 1, lines 6-9. An organic luminescent element generates light upon application of an electric field as the result of energy released when electrons from the cathode recombine with holes from the anode. See the application at page 1, lines 22-28.

In general, it was known that the luminescent efficiency of a luminescent film may be improved by inserting the luminescent layer between the hole transporting layer and the electron transporting layer. See the application at page 4, lines 4-23. However, this arrangement may produce an energy barrier at an interface between substances of different kinds. Such an energy barrier may inhibit movements of a carrier at the interface. See the application at page 6, lines 18-22. As noted above, the arrangement recited in the claims provides an approach for moderating such an energy barrier.

(6) Grounds of Rejection

Claims 1-11, 19, and 24-50 have been rejected as being anticipated by Jung (U.S. Patent Publication No. 2002/0018912).

(7) Argument

Appellant requests reconsideration and withdrawal of this rejection because Jung does not describe or suggest forming a layered structure that includes a first function region comprising a first organic compound, a mixed region on the first function region and including the first organic compound and a second organic compound, and a second function region on the mixed region and including the second organic compound, as recited in each of independent claims 1, 19, 33 and 44.

Jung is directed to an organic compound having one or more acetylene groups, and related thin films, processes and devices. Jung, at paragraph 0036, notes that formation of a polymer thin film may involve simultaneous deposition of more than two organic compounds. However, Jung nowhere describes or suggests forming the recited arrangement of a first function region, a mixed region, and a second function region.

This and similar arguments have been raised in the prior responses. In the advisory action, the Examiner merely stated that "The arguments are not convincing." without addressing the merits of the arguments. In the final office action, the Examiner appears to assert that Jung gives a choice of forming a layer by using a single organic compound or more than two organic compounds, and that this would inherently result in forming the arrangement of a first function region, a mixed region, and a second function region such as is recited in the claims. Stated another way, the Examiner appears to assert that Jung's system could be used to create the recited arrangement, and that the recited arrangement therefore is anticipated by Jung.

Appellant strongly disagrees. Even assuming for sake of argument that Jung's system could be used to form the arrangement recited in the claims, this is no way describes or suggests the recited arrangement, or provides any indication that use of Jung's system would inherently result in the recited arrangement. For example, Jung's system could be used to produce a structure that does not include the mixed region, a structure that does not include the recited first and second function regions, or one of myriad other structures.

Accordingly, for at least these reasons, the rejection should be reversed.

The brief fee of $500 is enclosed. Please apply any other charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

Date: 10/31/05

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Appendix of Claims

1. (Previously Presented) A method of depositing a layer comprising:

forming a first function region comprising a first organic compound on an electrode during irradiation with light in a deposition chamber;

forming a mixed region comprising the first organic compound and a second organic compound on the first function region during irradiation with light in the deposition chamber; and

forming a second function region comprising the second organic compound on the mixed region during irradiation with light in the deposition chamber.

2. (Previously Presented) A method of depositing a layer according to claim 1, wherein a direction of irradiation with light is the same as a direction of evaporating of the first organic compound and the second organic compound.

3. (Original) A method of depositing a layer according to claim 1, wherein an evaporation source from which the first organic compound is evaporated is differ from a evaporation source from which the second organic compound is evaporated.

4. (Original) A method of depositing a layer according to claim 1, wherein the first organic compound is evaporated from a first evaporation source and the second organic compound is evaporated from a second evaporation source.

5. (Original) A method of depositing a layer according to claim 4, wherein the first evaporation source and the second evaporation source are each provided in plurality.

6. (Original) A method of depositing a layer according to claim 4, wherein the first organic compound and the second organic compound are continuously deposited as continuously operating the first evaporation source and the second evaporation source.

7. (Original) A method of depositing a layer according to claim 4, wherein the mixed region is formed as simultaneously operating the first evaporation source and the second evaporation source.

8. (Previously Presented) A method of depositing a layer according to claim 4,

wherein the light is irradiated from a light source; and

wherein the light source, the first evaporation source, and the second evaporation source are on a same plane.

9. (Original) A method of depositing a layer according to claim 1, wherein the light uses an ultraviolet ray.

10. (Previously Presented) A method of depositing a layer according to claim 1, wherein the light has a wavelength of 100 to 300 nm.

11. (Original) A method of depositing a layer according to claim 8, wherein the light source is a low-pressure mercury lamp.

12-18. (Canceled)

19. (Previously Presented) A method of depositing a layer comprising:

forming a first function region comprising a first organic compound evaporated from a first evaporation source over an electrode in a deposition chamber during irradiation with light;

forming a mixed region comprising the first organic compound evaporated from the first evaporation source and a second organic compound evaporated from a second evaporation source on the first function region in the deposition chamber during irradiation with light;

forming a second function region comprising the second organic compound evaporated from the second evaporation source but not from the first evaporation source on the mixed region in the deposition chamber during irradiation with light.

20. (Previously Presented) A method of depositing a layer in a deposition apparatus, the deposition apparatus comprising:

a load chamber;

an alignment chamber;

a first deposition chamber for forming an organic compound layer on a first electrode, prepared with a first and a second evaporation sources and a light source;

a cleaning preliminary chamber;

a second deposition chamber for forming a second electrode; and

a sealing chamber,

wherein the first evaporation source comprises a first organic compound; and

wherein the second evaporation source comprises a second organic compound;

the method comprising:

forming a first function region comprising the first organic compound evaporated from the first evaporation source over the first electrode in the first deposition chamber during irradiation with light from the light source;

forming a mixed region comprising the first organic compound evaporated from the first evaporation source and the second organic compound evaporated from the second evaporation source on the first function region in the first deposition chamber during irradiation with light from the light source;

forming a second function region comprising the second organic compound evaporated from the second evaporation source but not from the first evaporation source on the mixed region in the first deposition chamber during irradiation with light from the light source.

21-23. (Canceled)

24. (Previously Presented) A method of depositing a layer according to claim 19, wherein a direction of irradiation with light is the same as a direction of evaporating of the first organic compound and the second organic compound.

25. (Previously Presented) A method of depositing a layer according to claim 19, wherein the first evaporation source and the second evaporation source are each provided in plurality.

26. (Previously Presented) A method of depositing a layer according to claim 19,

wherein the light is irradiated from a light source; and

wherein the light source, the first evaporation source, and the second evaporation source are on a same plane.

27. (Previously Presented) A method of depositing a layer according to claim 19, wherein the light uses an ultraviolet ray.

28. (Previously Presented) A method of depositing a layer according to claim 19, wherein the light has a wavelength of 100 nm to 300 nm.

29. (Previously Presented) A method of depositing a layer according to claim 26, wherein the light source is a low-pressure mercury lamp.

30. (Previously Presented) A method of depositing a layer according to claim 20, wherein a light irradiated from the light source is an ultraviolet ray.

31. (Previously Presented) A method of depositing a layer according to claim 20, wherein the light source is a low-pressure mercury lamp.

32. (Previously Presented) A method of depositing a layer according to claim 20, wherein a light irradiated from the light source has a wavelength of 100 nm to 300 nm.

33. (Previously Presented) A method of depositing a layer comprising:

forming a first function region comprising a first organic compound on an electrode in a deposition chamber;

forming a mixed region comprising the first organic compound and a second organic

compound on the first function region during irradiation with light in the deposition chamber; and

forming a second function region comprising the second organic compound on the mixed region in the deposition chamber,

wherein the mixed region includes organic compound molecules; and

wherein the light is irradiated to the mixed region so as to activate the organic compound molecules and promote for compact film formation.

34. (Previously Presented) A method of depositing a layer according to claim 33, wherein a direction of irradiation with light is the same as a direction of evaporating of the first organic compound and the second organic compound.

35. (Previously Presented) A method of depositing a layer according to claim 33, wherein an evaporation source from which the first organic compound is evaporated is differ from a evaporation source from which the second organic compound is evaporated.

36. (Previously Presented) A method of depositing a layer according to claim 33, wherein the first organic compound is evaporated from a first evaporation source and the second organic compound is evaporated from a second evaporation source.

37. (Previously Presented) A method of depositing a layer according to claim 36, wherein the first evaporation source and the second evaporation source are each provided in plurality.

38. (Previously Presented) A method of depositing a layer according to claim 36, wherein the first organic compound and the second organic compound are continuously deposited as continuously operating the first evaporation source and the second evaporation source.

39. (Previously Presented) A method of depositing a layer according to claim 36, wherein the mixed region is formed as simultaneously operating the first evaporation source and the second evaporation source.

40. (Previously Presented) A method of depositing a layer according to claim 33,

wherein the light is irradiated from a light source; and

wherein the light source, the first evaporation source, and the second evaporation source are on a same plane.

41. (Previously Presented) A method of depositing a layer according to claim 33, wherein the light uses an ultraviolet ray.

42. (Previously Presented) A method of depositing a layer according to claim 33, wherein the light has a wavelength of 100 nm to 300 nm.

43. (Previously Presented) A method of depositing a layer according to claim 40, wherein the light source is a low-pressure mercury lamp.

44. (Previously Presented) A method of depositing a layer comprising:

forming a first function region comprising a first organic compound evaporated from a first evaporation source over an electrode in a deposition chamber;

forming a mixed region comprising the first organic compound evaporated from the first evaporation source and a second organic compound evaporated from a second evaporation source on the first function region in the deposition chamber during irradiation with light;

forming a second function region comprising the second organic compound evaporated from the second evaporation source but not from the first evaporation source on the mixed region in the deposition chamber,

wherein the mixed region includes organic compound molecules; and

wherein the light is irradiated to the mixed region so as to activate the organic compound molecules and promote for compact film formation.

45. (Previously Presented) A method of depositing a layer according to claim 44, wherein a direction of irradiation with light is the same as a direction of evaporating of the first organic compound and the second organic compound.

46. (Previously Presented) A method of depositing a layer according to claim 44, wherein the first evaporation source and the second evaporation source are each provided in plurality.

47. (Previously Presented) A method of depositing a layer according to claim 44,

wherein the light is irradiated from a light source; and

wherein the light source, the first evaporation source, and the second evaporation source are on a same plane.

48. (Previously Presented) A method of depositing a layer according to claim 44, wherein the light uses an ultraviolet ray.

49. (Previously Presented) A method of depositing a layer according to claim 44, wherein the light has a wavelength of 100 nm to 300 nm.

50. (Previously Presented) A method of depositing a layer according to claim 47, wherein the light source is a low-pressure mercury lamp.

51. (Previously Presented) A method of depositing a layer in a deposition apparatus,

the deposition apparatus comprising:

a load chamber;

an alignment chamber;

a first deposition chamber for forming an organic compound layer on a first electrode, prepared with a first and a second evaporation sources and a light source;

a cleaning preliminary chamber;

a second deposition chamber for forming a second electrode; and

a sealing chamber,

wherein the first evaporation source comprises a first organic compound; and

wherein a second evaporation source comprises a second organic compound;

the method comprising:

forming a first function region comprising the first organic compound evaporated from the first evaporation source over the first electrode in the first deposition chamber;

forming a mixed region comprising the first organic compound evaporated from the first evaporation source and the second organic compound evaporated from the second evaporation source on the first function region in the first deposition chamber during irradiation with light from the light source; and

forming a second function region comprising the second organic compound evaporated from the second evaporation source but not from the first evaporation source on the mixed region in the first deposition chamber,

wherein the mixed region includes organic compound molecules; and

wherein the light is irradiated to the mixed region so as to activate the organic compound molecules and promote for compact film formation.

52. (Previously Presented) A method of depositing a layer according to claim 51, wherein a light irradiated from the light source is an ultraviolet ray.

53. (Previously Presented) A method of depositing a layer according to claim 51, wherein the light source is a low-pressure mercury lamp.

54. (Previously Presented) A method of depositing a layer according to claim 51, wherein a light irradiated from the light source has a wavelength of 100 nm to 300 nm.

Appendix of Evidence

Appendix of Related Proceedings